



Third MID-TERM EXAM 2012/2013

Course	Energy Conversion (EPM2106)	Time	90 minutes
Students	2nd Year (Electrical Power and Machines)	Mark	40

Answer ALL the following questions:

- Clarify your answer with the suitable sketches as you can.
- Assume any missed data reasonably.

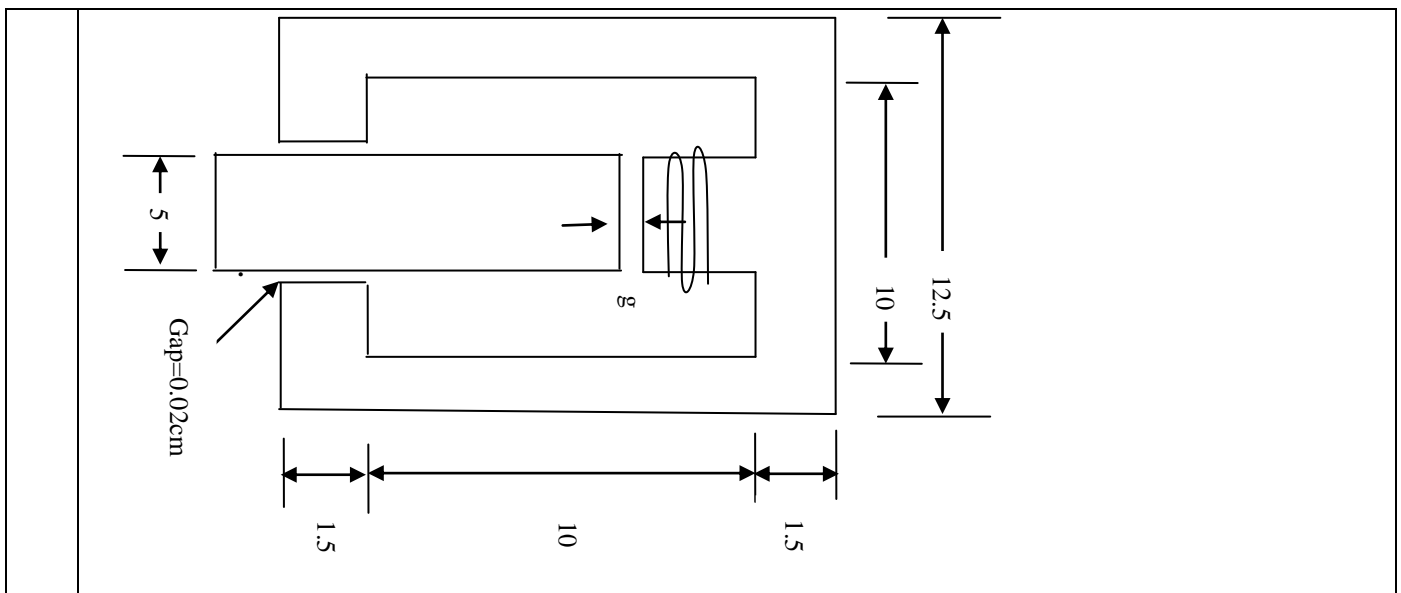
The first question (10 marks)

Which of the following statements is correct? You can write down in your answer sheet the question number followed by either ✓ or X mark.

1.	Inductance of a coil increases with increase in magnetic reluctance of its core.
2.	For a linear magnetic system, coil inductance does not depend on its current
3.	Motional (speed) voltage increases with increasing supply frequency
4.	Mutual inductance between two coils depends on their self inductances
5.	For linear magnetic system stored energy equals co-energy.
6.	Direction of electromagnetic torque is to increase inductance
7.	Transformer voltage depends on coil inductance variation with position.
8.	The mutual inductance between two magnetically coupled coils must be lower than the smaller self inductance of each coils
9.	For doubly excited rotating system, it is necessary to have some saliency for possible electromechanical energy conversion.
10.	Distributed winding provides more sinusoidal mmf space variation

The second question (10 marks)

1.	For a translational electro-mechanical energy conversion system, derive expressions for current, flux linkage and force in terms of stored energy and coenergy.
2.	<p>The device shown in the figure is a practical form of magnet. It is cylindrical about a vertical axis. The coil current carries a constant of 3.0 A. if the mmf in the iron is neglected.</p> <p>a- Compute the flux densities, in tesla, between the working faces of the center core and the plunger for gaps $g=0.25, 0.5,$ and 1.25 cm.</p> <p>b- Compute the corresponding values of the coil inductance, in henries.</p> <p>c- Compute the energy stored in the magnetic field for each value of the air gap.</p>

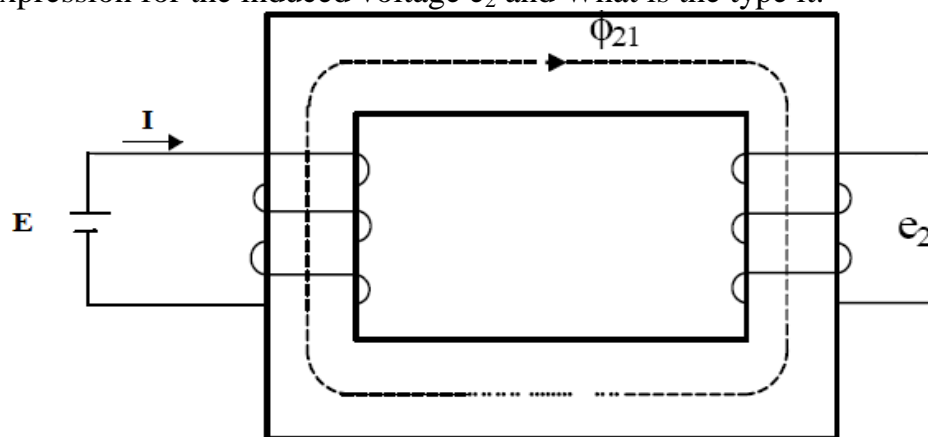


The third question (10 marks)

- 1 Show that the single-phase winding excited from an AC supply produces a pulsating MMF wave. Then show that this mmf can be viewed as the resultant of two rotating mmfs in opposite directions.
- 2 A doubly-excited rotating system with saliency associated with both the stator and the rotor. The stator self inductance has maximum and minimum values of 0.4 H and 0.2 H respectively, while maximum and minimum values of the rotor self inductance are 0.6 H and 0.4 H respectively. The maximum value of the mutual inductance between the two coils is 0.2 H. Find an expression for the torque acting on the rotor as a function of the angular position when stator current is 1 A and rotor current is 0.5 A. Sketch the variation of torque against rotor angular position.

The fourth question (10 marks)

- 1 Derive a general expression for the electromagnetic torque acting on the rotor of an AC single-excited device. The device has a cylindrical stator and rotor.
- 2 Derive an expression for the induced voltage e_2 and What is the type it.



Good Luck and best wishes
 Prof. Essam Eddin M. Rashad
 Dr. Abdelwahab Hassan